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ABSTRACT

A report describes the Purdue University Calumet Mechanical Engineering Technology (MET) program, especially the approaches used to enhance industrial involvement and take advantage of the urban setting to find real-life senior project problems. The outreach program, used by faculty to find student senior project material, is described along with the MET program's Autodesk Training Center which invites attenders to submit hands-on projects from their work to be done by MET senior design students. The report briefly discusses senior project courses, the resources available for senior projects, the university's Center for Community Services which handles the outreach program, faculty contacts, and the co-op program which is viewed as having been successful over the past four years in placing interested students in local industry. It is noted that outreach programs, whether they be formal technology transfer programs, extension or other non-credit courses, or professional and scholarly interactions, can provide a multitude of real-life senior project ideas and financial support. Conversely, a strong senior project component of a MET program can add an important element to the department's outreach activities. (GLR)

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MET Senior Projects at an Urban University

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ABSTRACT

Purdue University Calumet is located in Hammond, Indiana adjacent to Chicago. Purdue has the only TAC/ABET accredited MET programs in the Chicago area. Approaches used to enhance industrial involvement and take advantage of the urban setting to find real-life senior project problems are discussed in this paper. Students most frequently find senior projects at their jobs, and faculty find student senior project material in outreach programs of the University's Center for Community Service. The MET program runs an authorized Autodesk Training Center and invites attenders to submit hands-on projects from their work to be done by MET senior design students.

PURDUE UNIVERSITY CALUMET

Purdue Calumet is an academically autonomous Campus of Purdue University located in Hammond which is adjacent to Chicago in the Northwest corner of Indiana. The campus is approximately 30 minutes by car or train from the downtown Chicago Loop.

Purdue is a land grant university with a tradition of service to the people and institutions in the state of Indiana. Purdue is known for its schools of engineering and technology around the world. Purdue Calumet has about 10% of its student body of 8000 living out of state. The Campus has no dormitories so all students are commuters.

HEAVY AND SMALL INDUSTRY

Purdue Calumet enjoys a good relationship with industry partly because it has the only TAC/ABET accredited MET programs in the Chicago area. These programs are of the 2 + 2 type with the only MET Bachelors degree program in the metro area. On the Indiana side of the border, the steel industry and related businesses are major employers. On the Chicago side, manufacturing and service industries provide balanced employment. Faculty and students in the MET program have been able to take advantage of surrounding industry for practical real-life problems for senior projects.

SENIOR PROJECT APPROACH

A senior project should follow the following criteria to be approved by our MET faculty:

The work involved should be equivalent to a four credit hour course spanning two semesters.

The project should be feasible. It should not require expensive equipment purchase unless there is a grant that could be used for the project, or a company is willing to provide needed equipment. At present, the department has a portion of a $5,000 grant to be used for senior project equipment.

As a capstone course, the senior project should utilize the student's course work. In the case of a student working in the field, the project could be directly related to the type of job he or she is doing.

Students are strongly encouraged to select projects that incorporate hands-on work such as drawings, prototypes or models. Projects are to be supported by calculations and library activity.

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SENIOR PROJECT COURSES

After registering for the Senior Project Survey course (1 credit hour), the student contacts the faculty member whose specialty is in the area of his interest. The faculty member guides the student in choosing a project. After a project is approved, the student is required to study previous work done in that area, the scope of the project, costs, and justification. A short report about this proposal is written. He or she will submit and orally present this proposal for grading at the end of the semester.

In the next semester, usually the last semester of the senior year, the student registers for the Senior Project course (3 credit hours). The student carries out the project for this course as proposed in the survey the semester before. The student is required to meet with the faculty project advisor once a week to inform him about progress on the project. At the end of the semester, each senior project student makes a 20 minute presentation on his or her final project to an audience consisting of MET faculty and students.

The senior project presentations are an important part of the course. The presentation generates anxiety and excitement in the presenters. All seniors are requested to attend the presentations. Those who have done the survey part of the course get a chance to experience what is expected from their senior project presentations. They are required to make a short, 3 to 5 minute, presentation on their survey, and serve as an audience for those who have finished their projects and are graduating. The ones who are graduating make their presentations in a real-world atmosphere challenged by faculty members and fellow students to get ready to meet the demands of industry.

RESOURCES FOR SENIOR PROJECTS

AUTODESK TRAINING CENTER

The MET program uses AutoCAD in drafting & design classes and runs an Authorized AutoCAD Training Center offering non-credit workshops through the Institute for Continuing Education. An invitation to industry to submit senior projects for Purdue students is on all course brochures.

Purdue University Calumet was approved as an Authorized AutoCAD Training Center in 1986. In 1989 the university was approved as an AutoSolid Training Center and is the only such center in Northwest Indiana. Purdue University Calumet has also been approved as an Authorized Intergraph Education Center but we have not yet offered classes and are in the process of organizing this center. The AutoCAD seminars are offered through the Institute of Continuing Education of Purdue University Calumet in co-operation with the Department of Manufacturing Engineering Technologies and Supervision which houses the MET program.

Some of the seminars that are offered include Basic, Intermediate, Advanced, AutoLISP Programming, 3D/AutoShade, Customizing, AEC, AutoSolids and CAD/CAM. In 1989 we trained 81 students and in 1990 we expect to train about 120 students. Most of the students who enroll in these classes are from industries in Northwest Indiana and the south suburbs of Chicago. About 40 percent of the students are working as designers or engineers and the remaining 60 percent are in the drafting profession.

These classes give the MET faculty an opportunity to discuss some of the manufacturing and the design problems local industries are facing. The AutoCAD class promotion brochures mentioned above for requesting senior projects are mailed three times a year to industries, architects and AutoCAD users in Northwest Indiana, Chicago and suburbs. Once we have identified the companies that would welcome some help, we request them to put together a description of the project. These projects may be complicated designs or AutoLISP programming.

The projects that are received from companies are posted on the bulletin board and a memo is circulated to department faculty members. At this point we identify and consult with senior students who have the expertise to do a particular project. We will make suggestions and explain to the students what work would be involved in the project. If the student agrees to do the project, we put him or her in contact with the person in industry who is interested in having the student project undertaken. The faculty member supervises the student's work, provides guidance and help.

If we cannot find a student with the necessary expertise to do a project or if we cannot find a student who is interested, then the faculty member may offer to do it as a consulting project. In that case, the faculty member will directly contact the company and work out an agreement about a consulting fee and the work to be done for the project.

CENTER FOR COMMUNITY SERVICES

Purdue University Calumet has established an administrative structure to manage and seek ways of extending its community outreach.

Outreach Computer Lab Facility

A 22,000 square foot, $4.5 million computer education building was completed on campus this year. An outreach laboratory facility with space for 24 personal computers and a video projector system will enhance the programs of the Center for Community Services which include the Institute of Continuing Education when equipped. Currently AutoCAD is taught in a department lab equipped with 16, Zenith 286 and 386 PC's.

TAP Program

The technical assistance program (TAP) at Purdue is three years old. Its objective is to assist Indiana businesses, industries and government institutions in implementing new and advanced technologies. It is administered by the Univer-

sity's Engineering School in West Lafayette and supported by the Indiana Economic Development Council which is state funded. One faculty member from our department has served as the campus resource person working with local Indiana companies to transfer technology. The transfers are generally limited projects taking no more than a day of faculty time, a week of graduate student time, or a senior project taking one semester. Our department has had a student do a project for a sheet metal fabrication company in Gary, Indiana which was a plant layout and for a secondary steel fabricator of Hammond, Indiana which was an inventory control project using MRPII.

Outreach Center Grant

The University helped prepare a Grant Application to the National Bureau of Standards from the states of Indiana & Michigan for a pilot manufacturing outreach joint effort which was not funded but instead went to an Ohio facility. The University will continue to seek funding for outreach activities which would identify and support student senior projects in the future.

THE FACULTY AND STUDENTS

FACULTY CONTACTS AND CO-OP

MET faculty at Purdue Calumet are more involved in consulting and outreach than research. Through their experience with various companies in Northwest Indiana and Chicago, they have contacts in different industries who are aware of the high quality education our students receive at Purdue Calumet. Many of these contacts are former Purdue students.

Through these contacts, our faculty have been able to identify jobs as well as projects for our students. Faculty are frequently approached by employers for junior or senior level students. After some time on the job, students find themselves in a position to initiate a senior project which may be of use to their employer. Across all programs, 60% of Purdue Calumet students are part-time. Due to high local demand for MET students particularly in drafting and design, approximately 70% of associate level MET students and 85% of four year degree students work at least part time to support their studies.

The department started a Co-op program four years ago and has had good success in placing interested students in local industry. At present, the MET program has six Co-op students working at surrounding steel industry locations as well as at other companies like Northern Telecom, Motorola Corporation and smaller concerns. These students have excellent potential to initiate their own practical, hands-on senior projects after working several semesters at their Co-op company. Our Career Development and Placement Office is very active in marketing our Co-op students to employers and is constantly on the lookout for potential Co-op employers and Co-op students.

STUDENTS IDENTIFY PROJECTS FROM WORK

In most instances, the employer will be willing to pay equipment costs for work related senior projects, or the student will be allowed to use company equipment in their projects. For example, one of our students was hired by U.S. Steel in their Preventive and Diagnostic Maintenance Department after his A.A.S in MET. As his senior project, he proposed to study the relationship between machinery alignment conditions and machinery vibration which is of interest not only to the Steel industry, but other industries such as oil refining and the pulp and paper industry. All testing equipment were furnished by U.S. Steel with the student receiving donated material to build much of the machinery test rig. The student finished the program with an excellent understanding of the procedures that he had been applying by rote from an instruction book before doing the project.

Another example is a student of ours who was working at a machine shop. He made an adjustable box end wrench design at work for his senior project with the support of his boss who supplied materials and machining time.

GIFTS SUPPORTING PROJECTS

Each year the University sponsors a Phone-a-thon as part of the University Development Program. Department faculty and students call alumni to solicit donations for the department. One of the primary uses of this money which usually amounts to more than $500 a year is to purchase supplies for senior projects. Last year in addition to individual donations, a Chicago based corporation which employs our department's MET graduates and co-op students, Northern Telecom, provided a $5,000 donation earmarked for senior projects in three Purdue departments including ours.

A student project just completed during the spring semester of 1990 is the Automated Deburring Machine. It consists of a conveyor belt, a programmable logic controller (PLC), two pneumatic cylinders, a grinding wheel and a number of sensing devices. The part to be deburred is placed on the conveyor. The sensor that is mounted before a pneumatic vise senses the piece and signals the PLC to stop the piece and to clamp the part in the center of the vise. Once the part is clamped, another sensor sends a signal to the controller that activates the second pneumatic cylinder which lowers the grinding wheel. After the deburring process takes place for a preset time, the part is released from the clamp. While the department had the conveyor, the PLC, sensors, and other equipment needed for this project were purchased from the funding provided by Northern Telecom. We intend to use this equipment in the future to teach applications of programmable logic controllers. Provision has also been made in the project for several more stations which could be added to perform additional operations on the part in a future senior project.

THE INVENTORS & ENTREPRENEURS SOCIETY

A department faculty member who holds several patents started a chapter of The Inventors and Entrepreneurs Society (TIES) in 1984. He continues to serve as executive secretary. Meetings bring inventors to campus monthly from a wide area as our chapter is the only one in Indiana. Meetings bring members from Illinois, Michigan and Kentucky as well. Students and faculty are often called upon to evaluate inventions or otherwise help inventors without formal technical education. One student member of TIES used his design for removing chips from diesel engine cylinders as a senior project. This design won the student a $5,000 award from the GM Electromotive Division when submitted as a suggestion.

CONCLUSION

An outreach program whether it be formal technology transfer programs, extension or other non-credit courses, or professional and scholarly interactions can provide a multitude of real-life senior project ideas and financial support. Conversely, a strong senior project component of an MET program can add an important component to a department's outreach activities. In the event no interested student can be found to undertake a particular project, faculty consulting can be an alternative.